IN THE CLAIMS:

Please amend the claims as follows:

1. (Original) A flow-through electrode for use in a fuel cell, the electrode comprising:

a porous substrate comprising a first side for fluid ingress, a second side for fluid egress, a plurality of walls oriented in different directions between the first and second sides and defining voids between the walls, the walls including surfaces and micro-scale pores, wherein a multi-directional fluid flow path is defined between the first and second sides; and

a thin film disposed on the surfaces, the thin film comprising a catalytic material,

whereby a fuel and an electrolyte are flowable generally from the first side, through the voids and the pores of the substrate and in contact with the thin film, and to the second side.

2. (Original) The electrode according to claim 1 comprising a conductive component embedded within the substrate for conducting current from the electrode.

3. (Original) The electrode according to claim 1 wherein the substrate comprises sintered particles.

4. (Original) The electrode according to claim 1 wherein the substrate is formed as a metal sponge.

5. (Original) The electrode according to claim 4 wherein the sponge comprises nickel.

6. (Original) The electrode according to claim 1 wherein the substrate comprises a microstructure selected from the group consisting of open cellular, reticular, foamed, sintered, sponge, raney, nanostructure, vitreous, gel, sol-gel, aero-gel, and combinations thereof.

7. (Original) The electrode according to claim 1 wherein the substrate comprises a material selected from the group consisting of porous conductive plastics, carbon compounds, ceramics, metals, oxides of metals, nitrides or metals, alloys of metals, semiconductors, and combinations thereof.

8. (Original) The electrode according to claim 1 comprising microparticles disposed in the voids.

9. (Original) The electrode according to claim 8 wherein the microparticles comprise a catalytic material.

10. (Original) The electrode according to claim 9 wherein the catalytic material comprises platinum.

11. (Original) The electrode according to claim 8 wherein microparticles comprise an electrically conductive material.

12. (Original) The electrode according to claim 8 wherein the microparticles comprise a matrix of catalytic material supported on a support material.

13. (Original) The electrode according to claim 12 wherein the catalytic material comprises platinum and the support material comprises carbon.

14. (Original) The electrode according to claim 12 wherein the catalytic material comprises platinum and the support material comprises nickel.

15. (Original) The electrode according to claim 8 wherein the microparticles comprise high-surface area flakes.

16. (Original) The electrode according to claim 8 wherein the microparticles comprise filaments.

17. (Original) The electrode according to claim 1 comprising three-dimensional structures protruding from the walls into the voids.

18. (Original) The electrode according to claim 17 wherein the three-dimensional structures comprise nanostructures.

19. (Original) The electrode according to claim 1 wherein the walls have hollow interiors.

20. (Original) The electrode according to claim 19 wherein the thin film is further deposited on inside surfaces of the walls facing the interiors.

21. (Original) The electrode according to claim 1 wherein the thin film comprises a component selected from the group consisting of platinum, silver, gold, iridium, nickel, palladium, osmium, ruthenium, rhodium, rhenium, tungten, alloys thereof, oxides thereof, and nitrides thereof.

22. (Original) The electrode according to claim 1 wherein the thin film is substantially continuous.

23. (Original) The electrode according to claim 1 wherein the thin film is discontinuous.

24. (Original) The electrode according to claim 1 comprising a semipermeable membrane disposed at a side of the substrate, the membrane comprising a material substantially permeable to water and electrolyte and substantially impermeable to fuel.

25. (Original) The electrode according to claim 1 comprising a semipermeable membrane disposed at a side of the substrate, the membrane comprising a material substantially permeable to fuel and electrolyte and substantially impermeable to water.

26. (Original) The electrode according to claim 1 comprising a semipermeable membrane disposed at a side of the substrate, the membrane comprising a material substantially permeable to fuel and substantially impermeable to electrolyte and water.

27. (Currently amended) A flow-through electrode for use in a fuel cell, the electrode comprising:

(a) a first region and a second region each comprising a porous substrate for flowing a fuel/electrolyte combination therethrough and a thin film disposed on the substrate, the thin film comprising a catalytic material; and

(b) a third region interposed between the first and second regions and fluidly communicating with the first and second regions, wherein the pore density of the third region is less than the pore densities of the first and second regions.

28. (Original) The electrode according to claim 27 wherein the first and second regions are part of a contiguous substrate.

29. (Original) The electrode according to claim 27 wherein the third region is substantially hollow.

30. (Canceled)

31. (Currently amended) The electrode according to claim 27 [[30]] wherein each substrate comprises a plurality of walls oriented in different directions and a plurality of voids

between the walls, the walls include surfaces and micro-scale pores, and the thin film is disposed on the surfaces.

32. (Currently amended) A flow-through electrode for use in a fuel cell, the electrode comprising a plurality of regions, each region adjacent to and fluidly communicating with at least one other region, each region comprising a porous substrate for flowing a fuel/electrolyte combination therethrough and a thin film disposed on the substrate, the thin film comprising a catalytic material, and each region having a porosity different from the porosities of the other regions, wherein the plurality of regions are arranged in order of successively increasing porosity to define a porosity gradient whereby the fuel/electrolyte combination can be flowed generally with or against the porosity gradient.

33. (Canceled)

34. (Currently amended) The electrode according to claim 32 [[33]] wherein each substrate comprises a plurality of walls oriented in different directions and a plurality of voids between the walls, the walls include surfaces and micro-scale pores, and the thin film is disposed on the surfaces.

35. (Currently amended) A fuel cell comprising:

(a) an anode comprising a porous substrate and a thin film disposed on the substrate, the thin film comprising a catalytic material;

(b) a cathode;

(c) a porous barrier interposed between the anode and cathode;

(d) an anode-side channel defined between the anode and barrier for receiving a fuel-rich fluid; and

(e) a cathode-side channel defined between the cathode and barrier for receiving a fuel-depleted fluid.

36. (Canceled)

37. (Currently amended) The fuel cell according to claim 35 [[36]] wherein the substrate comprises a plurality of walls oriented in different directions and a plurality of voids between the walls, the walls include surfaces and micro-scale pores, and the thin film is disposed on the surfaces.

38. (Original) The fuel cell according to claim 35 comprising a separator device communicating with the anode-channel and the cathode-side channel for separating fuel from a fluid processed by the anode.

39. (Original) A fuel cell comprising:

(a) an anode comprising a first anode section, a second anode section and a third anode section, the first and second anode sections each comprising a porous substrate for flowing a fuel/electrolyte combination therethrough, and the third

anode section interposed between the first and second anode sections and fluidly communicating with the first and second anode sections;

(b) a cathode comprising a first cathode section and a second cathode section;

(c) a first channel interposed between the first anode section and the first cathode section; and

(d) a second channel interposed between the second anode section and the second cathode section.

40. (Original) The fuel cell according to claim 39 wherein the first and second anode sections are part of a contiguous substrate.

41. (Original) The fuel cell according to claim 39 wherein the pore density of the third anode section is less than the pore densities of the first and second anode sections.

42. (Original) The fuel cell according to claim 39 wherein the anode comprises a porous substrate and a thin film disposed on the substrate, and the thin film comprises a catalytic material.

43. (Original) The electrode according to claim 42 wherein the substrate comprises a plurality of walls oriented in different directions and a plurality of voids between the walls, the walls include surfaces and micro-scale pores, and the thin film is disposed on the surfaces.

44. (Currently amended) A fuel cell stack comprising:

(a) a first side, a second side opposing the first side, a third side, and a fourth side opposing the third side; ~~and~~

(b) a plurality of substantially planar electrodes arranged substantially parallel to each other and comprising respective edges defining the first, second, third, and fourth sides, the plurality of electrodes defining a plurality of first channels fluidly communicating with the first and second sides for conducting an oxygen-containing fluid generally from the first side to the second side, and defining a plurality of second channels fluidly communicating with the third and fourth sides for conducting a fuel/electrolyte combination generally from the third side to the fourth side; and

(c) a device fluidly communicating with the second channels for removing water from the fuel/electrolyte combination by a pressure differential.

45. (Original) The fuel cell stack according to claim 44 wherein the plurality of electrodes include anodes and cathodes, and at least one channel is interposed between and fluidly communicates with at least two anodes.

46. (Canceled)

47. (Currently amended) The fuel cell stack according to claim 44 [[46]] wherein the device comprises a conduit comprising a semipermeable wall for permitting transpiration of

water from the conduit and retention of fuel and electrolyte components within the conduit.

48. (Currently amended) The fuel cell stack according to claim 44 [[46]] wherein the device comprises a conduit comprising a semipermeable wall for permitting transpiration of fuel and electrolyte components from the conduit and retention of water within the conduit.

49. (Original) The fuel cell stack according to claim 44 comprising a device fluidly communicating with the second channels for removing heat from the fuel/electrolyte combination.

50. (Original) A fuel cell comprising:

(a) an anode region comprising a plurality of anodes and a plurality of anode channels, each anode channel communicating with at least one anode, the plurality of anode channels comprising pre-anode channels for supplying a fuel-rich fluid to one or more of the anodes and post-anode channels for receiving a fuel-depleted fluid from one or more of the anodes; and

(b) a cathode region comprising a plurality of cathodes and a plurality of cathode channels, each cathode channel communicating with at least one cathode and at least one anode channel.

51. (Original) The fuel cell according to claim 50 wherein the number of anodes is different from the number of cathodes.

52. (Original) The fuel cell according to claim 50 comprising a manifold communicating with the anode channels and the cathode channels for transferring electrolyte.

53. (Original) The fuel cell according to claim 52 comprising a device fluidly communicating with the manifold for removing water from the fuel-depleted fluid by a pressure differential.

54. (Original) The fuel cell according to claim 53 wherein the device comprises a conduit comprising a semipermeable wall for permitting transpiration of water from the conduit and retention of fuel and electrolyte components within the conduit.

55. (Original) A fuel cell comprising:

(a) an anode section comprising a first anode, a second anode and an anode channel interposed between and fluidly communicating with the first and second anodes, the first and second anodes each comprising a porous substrate for flowing a fuel/electrolyte combination therethrough; and

(b) a cathode section comprising a plurality of cathodes and a plurality of cathode channels, each cathode channel communicating with at least one cathode, and the plurality of cathode channels spaced from and communicating with the anode section.

56. (Original) The fuel cell according to claim 55 comprising a device fluidly communicating with the anode section for removing water from the fuel/electrolyte combination by a pressure differential.

57. (Original) The fuel cell according to claim 56 wherein the device comprises a conduit comprising a semipermeable wall for permitting transpiration of water from the conduit and retention of fuel and electrolyte components within the conduit.

58. (Canceled)

59. (Currently amended) A method for operating a fuel cell comprising:

(a) providing a flow-through electrode comprising a porous substrate and a catalyst disposed on the substrate; and

(b) flowing a fluid through the electrode, the fluid comprising an alkali electrolyte and an additive for supplying a supplemental source of hydroxyl ions.

60. (Canceled)

61. (Currently amended) The method according to claim 59 [[60]] wherein the hydroxyl-supplying additive is selected from the group consisting of buffers, polyhydroxyl alkalis, hydroxyl carriers, and combinations thereof.

62. (Original) The method according to claim 59 wherein the fluid further comprises an additive for cleaning the electrolyte.

63. (Original) The method according to claim 59 wherein the alkali electrolyte comprises a metal hydroxide.

64. (Original) The method according to claim 59 wherein flowing the fluid comprises flowing the fluid in a net forward direction that includes oscillatory components.

65. (Currently amended) A method for operating a fuel cell comprising:

(a) operating a plurality of electrodes comprising anodes and cathodes to collect electrons from the anodes; ~~and~~

(b) switching the operation of at least one electrode to a refresh cycle whereby catalyst supported by the electrode is cleaned, wherein switching comprises disconnecting the at least one electrode from an electron-receiving load; and

(c) applying an electric charge to one or more electrodes including the disconnected electrode.

66. (Canceled)

67. (Canceled)

68. (Canceled)

69. (Original) The method according to claim 65 comprising operating the at least one electrode in an electron-collecting cycle after cleaning the at least one electrode, and switching the operation of at least one other electrode to the refresh cycle.

70. (Original) The method according to claim 65 comprising operating an electrical controller to switch one or more electrodes between an electron-collecting cycle and a refresh cycle.

71. (Original) The method according to claim 65 comprising flowing an electrolyte-containing fluid through at least one of the electrodes in a net forward direction that includes oscillatory components.

72. (Original) The method according to claim 65 comprising flowing an electrolyte-containing fluid through the electrodes including the at least one electrode being refreshed.

Please add the following new claims:

73. (New) A fuel cell comprising:

(a) an anode;

(b) a cathode;

(c) a porous barrier interposed between the anode and cathode;

(d) an anode-side channel defined between the anode and barrier for receiving a fuel-rich fluid; and

(e) a cathode-side channel defined between the cathode and barrier for receiving a fuel-depleted fluid; and

(f) a separator device communicating with the anode-channel and the cathode-side channel for separating fuel from a fluid processed by the anode.

74. (New) The fuel cell according to claim 73 wherein the anode comprises a porous substrate and a thin film disposed on the substrate, and the thin film comprises a catalytic material.

75. (New) The fuel cell according to claim 74 wherein the substrate comprises a plurality of walls oriented in different directions and a plurality of voids between the walls, the walls include surfaces and micro-scale pores, and the thin film is disposed on the surfaces.

76. (New) A fuel cell stack comprising:

(a) a first side, a second side opposing the first side, a third side, and a fourth side opposing the third side;

(b) a plurality of substantially planar electrodes arranged substantially parallel to each other and comprising respective edges defining the first, second, third, and fourth sides, the plurality of electrodes defining a plurality of first channels fluidly communicating with the first and second sides for conducting an oxygen-containing fluid generally from the first side to the second side, and defining a plurality of second channels fluidly communicating with the third and fourth sides for conducting a fuel/electrolyte combination generally from the third side to the fourth side; and

(c) a device fluidly communicating with the second channels for removing heat from the fuel/electrolyte combination.

77. (New) The fuel cell stack according to claim 76 wherein the plurality of electrodes include anodes and cathodes, and at least one channel is interposed between and fluidly communicates with at least two anodes.

78. (New) The fuel cell stack according to claim 76 comprising a device fluidly communicating with the second channels for removing water from the fuel/electrolyte combination by a pressure differential.

79. (New) The fuel cell stack according to claim 78 wherein the device comprises a conduit comprising a semipermeable wall for permitting transpiration of water from the conduit and retention of fuel and electrolyte components within the conduit.

80. (New) The fuel cell stack according to claim 78 wherein the device comprises a conduit comprising a semipermeable wall for permitting transpiration of fuel and electrolyte components from the conduit and retention of water within the conduit.

81. (New) A method for operating a fuel cell comprising:

(a) providing a flow-through electrode comprising a porous substrate and a catalyst disposed on the substrate; and

(b) flowing a fluid through the electrode, the fluid comprising an alkali electrolyte and an additive for cleaning the electrolyte.

82. (New) The method according to claim 81 wherein the fluid further comprises an additive for supplying a supplemental source of hydroxyl ions.

83. (New) The method according to claim 82 wherein the hydroxyl-supplying additive is selected from the group consisting of buffers, polyhydroxyl alkalis, hydroxyl carriers, and combinations thereof.

84. (New) The method according to claim 81 wherein the alkali electrolyte comprises a metal hydroxide.

85. (New) The method according to claim 81 wherein flowing the fluid comprises flowing the fluid in a net forward direction that includes oscillatory components.

86. (New) A method for operating a fuel cell comprising:

(a) providing a flow-through electrode comprising a porous substrate and a catalyst disposed on the substrate; and

(b) flowing a fluid through the electrode in a net forward direction that includes oscillatory components, the fluid comprising an alkali electrolyte.

87. (New) The method according to claim 86 wherein the fluid further comprises an additive for supplying a supplemental source of hydroxyl ions.

88. (New) The method according to claim 87 wherein the hydroxyl-supplying additive is selected from the group consisting of buffers, polyhydroxyl alkalis, hydroxyl carriers, and combinations thereof.

89. (New) The method according to claim 86 wherein the fluid further comprises an additive for cleaning the electrolyte.

90. (New) The method according to claim 86 wherein the alkali electrolyte comprises a metal hydroxide.

91. (New) A method for operating a fuel cell comprising:

(a) operating a plurality of electrodes comprising anodes and cathodes to collect electrons from the anodes;

(b) switching the operation of at least one electrode to a refresh cycle whereby catalyst supported by the electrode is cleaned; and

(c) applying an electric charge to one or more electrodes whereby at least one of these electrodes undergoes the refresh cycle.

92. (New) The method according to claim 91 wherein switching comprises disconnecting the at least one electrode from an electron-receiving load.

93. (New) The method according to claim 92 wherein applying includes applying an electric charge to the disconnected electrode.

94. (New) The method according to claim 91 comprising operating the at least one electrode in an electron-collecting cycle after cleaning the at least one electrode, and switching the operation of at least one other electrode to the refresh cycle.

95. (New) The method according to claim 91 comprising operating an electrical controller to switch one or more electrodes between an electron-collecting cycle and a refresh cycle.

96. (New) The method according to claim 91 comprising flowing an electrolyte-containing fluid through at least one of the electrodes in a net forward direction that includes oscillatory components.

97. (New) The method according to claim 91 comprising flowing an electrolyte-containing fluid through the electrodes including the at least one electrode being refreshed.

98. (New) A method for operating a fuel cell comprising:

(a) operating a plurality of electrodes comprising anodes and cathodes to collect electrons from the anodes;

(b) switching the operation of at least one electrode to a refresh cycle whereby catalyst supported by the electrode is cleaned;

(c) operating the at least one electrode in an electron-collecting cycle after cleaning the at least one electrode; and

(d) switching the operation of at least one other electrode to the refresh cycle.

99. (New) The according to claim 98 wherein switching the operation of the at least one electrode comprises disconnecting the at least one electrode from an electron-receiving load.

100. (New) The method according to claim 99 comprising applying an electric charge to one or more electrodes including the disconnected electrode.

101. (New) The method according to claim 98 comprising applying an electric charge to one or more electrodes whereby at least one of these electrodes undergoes the refresh cycle.

102. (New) The method according to claim 98 comprising operating an electrical controller to switch one or more electrodes between an electron-collecting cycle and a refresh cycle.

103. (New) The method according to claim 98 comprising flowing an electrolyte-containing fluid through at least one of the electrodes in a net forward direction that includes oscillatory components.

104. (New) The method according to claim 98 comprising flowing an electrolyte-containing fluid through the electrodes including the at least one electrode being refreshed.

105. (New) A method for operating a fuel cell comprising:

(a) operating a plurality of electrodes comprising anodes and cathodes to collect electrons from the anodes;

(b) switching the operation of at least one electrode to a refresh cycle whereby catalyst supported by the electrode is cleaned; and

(c) flowing an electrolyte-containing fluid through at least one of the electrodes in a net forward direction that includes oscillatory components.

106. (New) The method according to claim 105 wherein switching comprises disconnecting the at least one electrode from an electron-receiving load.

107. (New) The method according to claim 106 comprising applying an electric charge to one or more electrodes including the disconnected electrode.

108. (New) The method according to claim 105 comprising applying an electric charge to one or more electrodes whereby at least one of these electrodes undergoes the refresh cycle.

109. (New) The method according to claim 105 comprising operating the at least one electrode in an electron-collecting cycle after cleaning the at least one electrode, and switching the operation of at least one other electrode to the refresh cycle.

110. (New) The method according to claim 105 comprising operating an electrical controller to switch one or more electrodes between an electron-collecting cycle and a refresh cycle.

111. (New) The method according to claim 105 comprising flowing an electrolyte-containing fluid through the electrodes including the at least one electrode being refreshed.

112. (New) A method for operating a fuel cell comprising:

(a) operating a plurality of electrodes comprising anodes and cathodes to collect electrons from the anodes;

(b) switching the operation of at least one electrode to a refresh cycle whereby catalyst supported by the electrode is cleaned; and

(c) flowing an electrolyte-containing fluid through the electrodes including the at least one electrode being refreshed.

113. (New) The method according to claim 112 wherein switching comprises disconnecting the at least one electrode from an electron-receiving load.

114. (New) The method according to claim 113 comprising applying an electric charge to one or more electrodes including the disconnected electrode.

115. (New) The method according to claim 112 comprising applying an electric charge to one or more electrode whereby at least one of these electrodes undergoes the refresh cycle.

116. (New) The method according to claim 112 comprising operating the at least one electrode in an electron-collecting cycle after cleaning the at least one electrode, and switching the operation of at least one other electrode to the refresh cycle.

117. (New) The method according to claim 112 comprising operating an electrical controller to switch one or more electrodes between an electron-collecting cycle and a refresh cycle.

118. (New) The method according to claim 112 comprising flowing an electrolyte-containing fluid through at least one of the electrodes in a net forward direction that includes oscillatory components.